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ABSTRACT

Designed to provide background for the planning of collection preservation programs in the libraries of the University of California, this paper presents an overview of the preservation problem, makes specific recommendations for further programs within the University of California library system, and assesses the needs of the system with regard to: (1) environmental control within buildings housing collections, (2) training of conservation administrators and preservation specialists, (3) restoration of deteriorating collections, and (4) research into the causes and cures of paper deterioration. Estimated costs of a program addressing these four areas are given. A bibliography lists 37 references. (FM)

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CONSERVATION AND PRESERVATION PROGRAMS FOR THE UNIVERSITY OF CALIFORNIA LIBRARIES: PROBLEMS, PROGRAMS, AND COSTS

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Library Studies and Research Division
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University of California - Systemwide Administration

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Taking into consideration the permanency of the Library, a grave question arises, growing out of the modern conditions in the manufacture of paper. The changes in the processes of manufacture, its extreme cheapness because of the use of chemicals and wood, have resulted in the publication of a large variety of newspapers, cheap magazines, and other works, which threaten in a few years to crumble into a waste heap, with no value as a record.

1st Annual Report of the
Librarian of Congress, 1897

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Preface

This document attempts to synthesize a wide variety of information and opinion to provide background for planning of conservation and preservation programs for the libraries of the University of California. University documents as well as published literature, consultation with conservators, empirical research and personal experience have been utilized in preparing this paper. Our purpose is to present a brief overview of the conservation/preservation problem and to make specific recommendations for further programs within the University of California library system. Many of the recommendations that I have tendered have been proposed by other authors, especially J. Michael Bruer of the California Library Authority for Systems and Services and David Heron, consultant to the Assistant Vice President--Library Plans and Policies. Their endeavors (1,2) in turn are indebted to the work of University of California Task Group on the Preservation of Library Material (3).

SUMMARY

This paper provides a brief overview of the problem of deteriorating books in large research libraries. The following findings and recommendations specific to the University of California libraries are presented, in greater detail, in the paper:

General Collections

Findings - As many as 32% of the bound volumes in the collections of the University libraries are classifiable as being printed on paper that currently is of a poorer quality than low-quality newsprint. 4.5% of the bound volumes are "brittle books" and need microfilming.

Recommendations - Procedures should be instituted to decrease the amounts of material published on inherently instable paper. Research into methods of mass deacidification which are safe and economical should be advanced by systemwide staff. Programs should be instituted to microfilm brittle books and to provide information that such work was done.

Special Collections

Findings - The rare book and special collections need extensive treatment to insure their survival for the use of future generations.

Recommendations - The special collections should be assessed for the amounts and types of treatment needed to restore them to a suitable condition and to preserve them in that condition. Conservation personnel need to be recruited and trained. A file listing special collections items treated, and the treatment performed, should be instituted.

Environmental Control

Findings - Environmental control of both temperature and humidity is currently the cheapest treatment to slow the deterioration of library materials.

Recommendations - All general libraries which currently have environmental control systems should have the systems evaluated for efficiency and adequacy. Those general libraries which do not have such environmental control systems should be given the resources to install such systems as soon as possible.

Costs

Estimated costs for the programs briefly noted above are given below:

Area	Campuses Involved	Estimated Cost
1. Environmental Control	4	$ 7,400,000
2. Training	9	1,958,000
3. Treatment	9	
a. Microfilming	9	25,500,000
b. Restoration	9	2,020,000
c. MARC Records	9	30,000
4. Research	(Systemwide?)	1,500,000
		$38,408,000

INTRODUCTION

The deterioration of paper is a well known and lamentable phenomenon. Many monographs and hundreds of periodical articles have been written which deal with the causes of degradation in paper. George Cunha's two-volume "Conservation of Library Materials" lists a bibliography of some 4,000 entries, many of which deal with this problem (4). The causes of paper deterioration are numerous: inherent acidity, ultra-violet radiation, fluctuations in temperature and humidity, microbiological agents, rodents, people, fire, flood, etc. (5, 6, 7). Of the multitude of enemies of library material, the most insidious is the acidity of most book papers. Beginning around 1870, the introduction of mechanical or gound wood pulp and certain chemical wood pulps placed a devastating time bomb in almost every book published. The processes which allowed the production of large quantities of cheap paper introduced destructive materials in the form of lignin (a natural constituent of cellulose fibers), chemicals from the pulping process, and alum in the sizing. For a clear, concise, review of the history of paper, read Verner Clapp's article, "The Store of Permanent/Durable Book-Paper" (8). Browning also provides a brief review of the history and nature of paper (9).

By the 1890's serious concern was being voiced about the deterioration of books and newspapers then being published in the United States (10, 11). Newspapers were a particular problem in that they disintegrated quite rapidly, a problem no less extreme today. Beginning with these early complaints, individuals and professional committees have called for the use of permanent, archival, papers in publishing (12, 13, 14). Early in this century, Alexander Graham Bell and others proposed printing archival material on gold, platinum or silver sheets; others proposed the use of pottery (15, 16). The University of California Press, at an early date, began printing depository copies of their publications on "permanent paper." This printing effort continued from 1933 until the death of the custodian of this effort in 1944 (17). The Press is once again concerned with this problem and attempts to print on an acid free (neutral ph) paper of high quality (18).

Although there was great concern about paper deterioration on the part of some individuals and groups for over five decades (e.g., 19), the enormity of the problem was not really understood until the 1960's. In the mid-1960's the W. J. Barrow Research Laboratory, using grant funds from the Council on Library Resources, began publishing a series of studies designed to assess the deterioration of book papers and to find methods to reduce or reverse this process (20). In general, Barrow's studies showed that, of books which were printed between 1800 and 1899, 31% had to be accounted unusable (21). Books with imprint dates between 1900 and 1939 gave slightly worse results; 39% of the papers tested fell into the unusable category. Tests of book papers from the 1940-1949 printing years which had aged only 7-17 years showed 57% of the samples had deteriorated to the strength level of newsprint: usable but rapidly deteriorating (22).

In the 1970's, having been stirred to action by the disturbing reports from the Barrow Laboratory and by the evidence of their own experience, curators of several large research libraries in the United States had evaluated the scope of the problem of paper deterioration in their collections. The New York Public Library reported in 1960 that approximately half of its research

collection needed conservation attention (23). In 1971, the Library of Congress reported that 6 million of their bound volumes were too brittle to be handled by patrons (24). Some time after this disappointing news, the curators of the McAlpin Collection at the Union Theological Seminary in New York were told by their consultants that a conservation/binding expenditure of $50,000 per year would be necessary over the next 20 years simply to maintain the collection in its presently unsuitable condition (25).

When the cost of coping with the problem of deteriorating collections was addressed by the New York Public Library, it estimated, in 1964, that it would cost $12 million to restore its deteriorated collections to a usable condition for circulation. This included only routine binding and basic repair (26). Although the Library of Congress does not appear to release specific budget information for its preservation and restoration effort, in 1977 about 43,000 "rare books and related materials [were] bound, rebound, restored, reconditioned, or otherwise treated." In addition, 27,000 maps, manuscripts, prints, and photographs were preserved, restored, or otherwise treated. This same year saw 5,343,000 microfilm exposures taken of brittle books and serials, at a cost of $535,000 (27). The Preservation and Restoration staff--including research, restoration, binding, and microfilming--is about 130 persons; of these about 37 positions are currently allocated to restoration of rare books. The Library of Congress estimates that there are 11,500 person-years of restoration work to be carried out on its rare books: that is, 300 years of work for each of the 37 positions (28).

In 1975 a survey of the British Museum Library revealed that 10% of the collection--about 1 million volumes--was in need of repair even though the conservation/binding budget was at a level of $3 million. This finding was of such intense concern that subsequent to the 1975 report the British Museum Library increased its conservation and binding budget in fiscal year 1977-78 to $4 million. During that year the British Museum Library was employing approximately 133 persons in the binding/conservation department although the number of staff dedicated exclusively to conservation is not known (29).

The foregoing exemplifies the problems of deteriorating book collections in some major research libraries. Other library materials face similar fates. For example, collections of photographic material, including microforms, are quite prone to deteriorative processes. Microfilm stored at Richmond, for instance, has been damaged by a combination of poor processing and deleterious storage conditions.

Although the problems noted above are well documented for many other institutions, questions arise: "Do such problems obtain in the University of California libraries?" "What resources are now committed to combating these problems?" The following section of this paper documents the existence of problems in the UC libraries which are as severe as those reported by other institutions.

THE PROBLEM

The general problem facing the University libraries which overrides the specific problems delineated below is the lack of centralized responsibility for the planning and implementation of conservation/preservation programs. In the recommendations section presented later in this paper, the critical importance of the campus library Conservation Officer is elaborated. In this section of the paper, specific problems of conservation and preservation in the UC libraries are addressed.

I. General Collections

In response to the recommendation of the UC Task Group on Preservation of Library Materials, the Library Studies and Research Division of the Office of the Assistant Vice President--Library Plans and Policies undertook a major effort to collect data with which we could assay the physical and chemical state of paper in books in the general collections of the UC libraries. Although the report of this study is in preparation, some preliminary findings can guide our evaluation in this area. We can assign percentages of the samples tested to strength categories developed by Barrow (30). The Barrow categories are based upon two physical tests of paper permanence: tear resistance and folding endurance. The Barrow categories are, in decending order: 1) high strength, 2) moderate strength, 3) low strength, 4) weak strength, 5) unbindable, and 6) near dust. Samples in the "weak strength" category represent books that are suitable for use in a rare book room only where users are cautioned to handle them with care. The categories unbindable and near dust are self-explanatory. Of the samples of book paper taken from UC Libraries, 16.4% could be classified in the Barrow categories of unbindable and near dust. This indicates that 16.4% could either break when folded three times or less or could tear in half with a pull of 18 grams or less. Three United States twenty-five cent pieces weigh about 18 grams. When items with a strength less than that of the poorest newsprint are added to the categories noted above, the percentage reaches 32.4%. This indicates that 32.4% of the book papers tested were currently of a poorer quality than low-quality newsprint. If these percentages are used to project to the entire collection, we see the enormity of the problem. Based on the University libraries' 1978 collection size (31) of 15,968,135 bound volumes, approximately 2,620,000 volumes in the UC libraries may be classifiable as unbindable or near dust. An additional 2,555,000 volumes may be classified as having less strength than weak quality newsprint.

In many of these "unusable" volumes the paper is chemically "dead" and no amount of treatment will restore these volumes to a usable condition. These materials require microfilming of archival quality to preserve the intellectual content. It is estimated that such material is represented by 4.5% of the UC libraries' collections or about 715,000 volumes.

Data presented above supports previous findings which indicate that any major research library may find about 25% of its general collection classifiable as "brittle books." Large scale processes designed

to retard the transition of library material to the "brittle book" stage or to arrest the further deterioration of materials already at that stage are termed "mass deacidification" techniques. Many pilot projects for mass deacidification of library material have been proposed but none have proven themselves commerically practical. The basic problems with all but one of these techniques is that they demand major capital expenditures for equipment and require extensive handling and sorting of the material to be deacidified. Each item must be taken from its location in the library, transported to the deacidification chamber, treated, returned to the library, and reshelved. At a minimum, circulation records would need to be kept as is done with material going to mending or binding.

Many of these deacidification treatments are dangerous to the materials (e.g., pyroxiline book covers may melt) or to the staff processing the materials. The process currently under development by the Library of Congress (LC) uses diethyl zinc as the deacidification agent. This product explodes into flames when it comes in contact with the air: obviously this process is not one to be undertaken by local library staff without extensive training, nor can it be implemented without investment in special equipment. With the successful application of the diethyl zinc gas, zinc ions are deposited upon the paper: the zinc reacts to light and the result is quite damaging to the paper. The LC process now involves injection of hydrogen iodide to desensitize the zinc which deacidifies the paper. Hydrogen iodide is toxic and is a strong irritant to the eyes and the throat. In the presence of moisture hydriodic acid is formed (32). I find little to recommend this procedure at this time.

The Langwell process (33), on the other hand, offers promise of an easily applied deacidification method which involves no expensive equipment and does not require materials to be removed from their locations in the library. This process involves interleafing the library material at intervals of 50 pages or placing tablets in storage boxes. The deacidification is accomplished by the action of cyclohexylamine carbonate which is impregnated in the interleaf sheets (34) or is formed into tablets with an inert substance as a binder. The materials are deacidified over a period of a few weeks and can remain on the shelf or in containers during this time.

There is some controversy about the toxicity of cyclohexylamine carbonate at this time (35). This problem may only exist, however, in conditions approaching 100% humidity with rapid movement of the surrounding air (a condition not often found in libraries in the UC system). The Library Studies and Research Division is currently working with Dr. Bruce Ames, a UC Berkeley biochemist, on this toxicity problem. Dr. Ames is most noted for his development of simple, practical tests for testing carcinogenic activity of chemicals.

II. Special Collections

In 1973 a book-by-book survey of the rare books in a Special Collections department of a UC library was undertaken by skilled book

binders and restorers. An examination of over 14,000 bound volumes indicated that 60% of the collection needed immediate treatment while an additional 13% would require treatment during the next five years. The estimated cost in 1973 for all work needed through 1978 was $182,117, or $36,423 per annum for five years. The cost of doing this work now is calculated at $329,492 in 1978 dollars. Table 1 details these estimates. It should be noted that the cost assessments are for work done by private restorers and binders who are not personnel of the University libraries. Unfortunately, cost projections for all "rare books" in the UC libraries are impossible to calculate because only two Special Collections departments count "rare books" as separate from "special collections" material.

In addition to the rare books and their problems, there is probably major work to be done to manuscripts. The 58,477,389 manuscript items reported in 1978 in the UC library statistical tables have not been systematically evaluated for priority of treatment, but many are known to be stored under unacceptable environmental conditions.

Other categories of material which require care are the extensive collections of non-print media (e.g., photographic prints and negatives). The photographic collections are not reported in the library statistical reports, but are estimated to include several million prints and negatives. The Bancroft Library alone is believed to contain over one million prints and reports over 40 collections of photographic material. UC Riverside has recently acquired 500,000 glass negatives of stereopticon slides.

In 1977, according to the UC Task Group Report, the University libraries were providing approximately 3.5 FTE systemwide for the in-house maintenance of these collections. By 1979 this figure had reached 6.0 FTE systemwide.

The conservation and preservation of rare book and special collections of the University libraries is a quantitatively and qualitatively different problem than that posed by the general collections. Special and rare materials require individual treatment that can only be performed by highly skilled personnel. This labor-intensive work is not only inherently slow but is quite expensive. However, it is clear that there is no substitute for this painstaking approach. Mass treatments, modern materials, and cheap shortcuts can ultimately--if not immediately--ruin library material of artistic, monetary, or historical interest.

Even if the University libraries had the financial resources to implement conservation and preservation programs for the rare and special collections, it is doubtful that the trained personnel could be found to do the work. At this time we know of only three schools in the United States for the training of hand book binders and document restorers. Two of these institutions train for their own needs while the third is a private, tuition-charging school. In a recent article, Paul Banks, Chief Conservator at the Newberry Library, has summarized the unfortunate state of affairs in this area (36).

TABLE 1

PRESERVATION AND RESTORATION COSTS
FOR A RARE BOOKS DEPARTMENT: 20 YEAR PROJECTION

TREATMENT	DATE NEEDED	NUMBER OF VOLUMES	1978 COST PER VOLUME	1978 COST TOTAL
Cleaning and Dressing	1973	6,381	$ 3.00	$ 19,143
Deacidification Mildew Treatment Repairs	1973	1,447	42.80	61,908
Major Repair	1973	742	101.70	75,436
Deacidification Mildew Treatment Repairs	1973-1978	1,855	82.90	153,862
Cleaning and Dressing	1978	6,381	3.00	19,143
NEEDED THROUGH 1978 (SUBTOTAL)				$329,492
Deacidification Mildew Treatment Repairs	1983	569	82.90	47,170
Cleaning and Dressing	1985	6,381	3.00	19,143
Cleaning and Dressing	1990	6,381	3.00	19,143
Deacidification Mildew Treatment Repairs	1993	322	82.90	694
Cleaning and Dressing	1995	6,381	3.00	19,143
NEEDED 1983-1995 (SUBTOTAL)				$105,293
NEEDED 1973-1995 20 YEAR TOTAL				$434,785

III. Environmental Control

Environmental control is the highest priority treatment for deteriorating library collections because it is effective in slowing the deterioration of books and the technology is well understood. This stabilizing treatment is a relatively inexpensive way to significantly extend the lifespan of deteriorating materials, costing about $1.00 per volume. Table 2, below, illustrates the relationship of temperature to the lifespan of library materials.

TABLE 2

EFFECT OF STORAGE TEMPERATURE
ON PAPER IMPERMANENCE (37)

AVERAGE STORAGE TEMPERATURE		Paper Half-Life (in Years)*	AVERAGE STORAGE TEMPERATURE	
F.	Diff. from 68° F. (in° F.)		C.	Diff. from 20° C. (in° C.)
140	+72	1	60	+40
122	+54	4.1	50	+30
104	+36	18	40	+20
95	+27	40	35	+15
86	+18	88	30	+10
77	+ 9	204	25	+ 5
72.5	+ 4.5	320	22.5	+ 2.5
68	.....	490	20	.....
63.5	- 4.5	760	17.5	- 2.5
59	- 9	1,200	15	- 5
50	-18	3,100	10	-10
41	-27	7,900	5	-15
32	-36	21,000	0	-20
14	-54	170,000	-10	-30
- 4	-72	1,700,000	-20	-40

* One folding endurance half-life is defined as one year at 60° C. (140° F.) for purposes of estimating half-life at lower temperatures.

The precise needs of the University of California (UC) libraries for environmental control of library buildings would require a special survey for which we lack the necessary time. However, it is possible to estimate the costs of retro-fitting those campus library systems

which currently have no air conditioning and humidity control or which have extremely poor systems. At least four campus library systems are known to fit this category: Berkeley, San Francisco, Santa Cruz, and Davis. To bring these systems up to current standards would require the provision of air temperature and humidity control for about 920,000 assignable square feet (ASF).

IV. Summary of the Problems

A brief reiteration of the problem section presented above may facilitate understanding of the recommendations made in the next section.

1) General Collections. Millions of bound volumes printed on inherently instable paper are deteriorating in the collections of the UC libraries. Techniques to deacidify these materials cheaply and safely, in large numbers, is desperately needed.

2) Special Collections. Material that is of historic, artistic, or monetary value requires specialized treatment to preserve and restore the material for later generations. The lack of surveys which would assess resource needs is critical to budget planning while the lack of trained personnel is acute throughout the United States.

3) Environmental Control. Control of the temperature and humidity in buildings housing library collections is a top priority and is needed to retard the further deterioration of the materials.

THE RECOMMENDATIONS

I. General Collections

A. This recommendation is contingent upon the toxicity of cyclohexylamine carbonate (CHC). If CHC proves too toxic for use in libraries or regional compact shelving facilities our recommendation is to support an outside agency such as the University's Forest Products Laboratory in development of new non-aqueous deacidification agents.

B. If CHC proves not to be toxic our recommendation is to implement a pilot test of the application and efficacy of this method of mass deacidification. Conservation scientists at the Conservation Center of the National Museums of Canada have indicated their willingness to cooperate in the testing phases of such a program.

C. University librarians and systemwide staff should become involved with national organizations such as the ALA Preservation Committee, the Technical Committee for Standards of the Association of American University Presses, etc. Within such groups, the University representatives should strive to establish standards for library materials including, but not limited to, paper strength, adhesives, inks, and bindings. The problem of the brittle book in the general collections must be reduced and the simplest method of attacking the problem is to insist books be printed on acid free paper.

II. Special Collections

A. University representatives should work closely with the California Library Authority for Systems and Services and the Western Council of State Librarians in their efforts to establish preservation programs in the West. If it appears that these programs will be unable to initiate suitable training programs (especially for preservation of rare materials) in the near future the University should recruit and financially support a small number of talented individuals during training in available programs. One suitable private school program is located in Berkeley, California; the Conservation Center of the Institute of Fine Arts, New York University, is currently planning such a program.

B. A systemwide team of librarians, or better still one librarian from each special collections department, should be trained to assay the rare and special collections for the amounts and types of treatments needed. We know the extent of the conservation/preservation problem in the general collections, but only one special collections unit has been formally surveyed--the rare books only--for the work needed. Without such estimates of need their is currently no way to make budget projections which would be meaningful.

C. As noted in an earlier section, some amount of material in the collections of the University libraries is printed on chemically

"dead" paper. These materials should be microfilmed to preserve their intellectual content. It is recommended that library and systemwide personnel be designated to establish methods for the preservation of microfilm masters in the UC library collections. It is further recommended that this group plan the creation of a master file of items microfilmed. This would prevent duplication of this expensive work.

D. Finally it is recommended that library staff work with systemwide personnel to develop a records management system, perhaps through the online catalog or other automated system, to allow notation of the condition of special collections material and any treatment performed on such material to preserve or restore the item.

III. Environmental Controls

The control of temperature and humidity in buildings housing library collections is a vital first step in the preservation of the materials in those collections.

A. In the long run, each University General Library should be scientifically evaluated for the adequacy of its environmental control system. This evaluation program should begin with those libraries located in areas of the greatest environmental extremes.

B. It is further recommended that resources be sought to retro-fit the Berkeley, San Francisco, Santa Cruz and Davis General libraries with adequate environmental control systems.

IV. Summary of Recommendations

The recommendations provided to the Assistant Vice President--Library Plans and Policies by J. Michael Bruer and David Heron are supported by further findings of the Library Studies and Research Division staff. Stated in broad terms these recommendations are:

1) That University librarians and systemwide staff work to slow the production of library material which is printed on unsuitable paper, and that systemwide staff continue to pursue safe, economical methods of mass deacidification for deteriorating library material.

2) That University librarians and systemwide staff plan and implement programs to:

a) assess the needs of special collections

b) recruit and have trained preservation personnel

c) insure the preservation of UC microfilm masters

d) develop records management procedures for describing the condition of special collections materials and their perservation/restoration treatment.

3) That the environmental control systems currently in campus general libraries be evaluated for adequacy of performance, and that the Berkeley, San Francisco, Santa Cruz, and Davis general libraries be retro-fitted with such systems.

COSTS OF PROGRAMS

Any local or national conservation and preservation program for library material must address, as noted above, at least four areas of primary responsibility. These are in priority order:

I) Environmental control within buildings housing collections

II) Training of conservation administrators and preservation specialists

III) Treatment to slow and repair deterioration of the collections

IV) Research into the causes and cures of paper deterioration

V) Summary of estimated program costs

In the text that follows the needs of the University of California libraries in each of these four areas are estimated and costs of meeting those needs are provided.

I. Environmental Control

Four campus general library systems need retro-fitting of environmental control systems: Berkeley, San Francisco, Santa Cruz, and Davis. To bring these systems up to current standards would require the provision of air temperature and humidity control for about 920,000 assignable square feet (ASF). The estimated cost of this program, at $8.00/ASF, is $7,360,000. This is a minimum estimate as many branches on other campuses probably need similar controls and are not included in the figures noted above.

II. Training

The second program priority is the training of conservation administrators and preservation specialists. This is a high priority because it takes three to five years, after initiation of training, before the sponsoring institutions begin to receive major benefits from the trainees. There are three levels of training that are currently needed:

1) Conservation and preservation program administration
2) Special collections survey techniques
3) Book binding and paper restoration

1. Conservation and Preservation Program Administration

Training for librarians in the administration of conservation and preservation programs is not currently available in formal academic programs. However, such a program will soon be offered by the Columbia University library school in New York city. At least two UC librarians should be sent for training as soon as the program is under way. At the end of the proposed three year

program UC could use these two librarians as regional program coordinators; eventually each campus should have a trained conservation and preservation administrator. If all such training were done at Columbia, this training might cost about $25,000 per year, per person (including salary). Total costs are estimated to be about $500,000 over the duration of the program. That is:

Year	Number in Program	Cost in that Year
1	2	$ 50,000
2	4	100,000
3	4	100,000
4	4	100,000
5	4	100,000
6	2	50,000
	Total	$500,000

2. Special Collections Survey Techniques

This training is a prerequisite to any treatment program involving the special or rare book collections. It is specifically directed at teaching special collections curators techniques to assess their collections for treatment. Without such training the extent of the preservation problem in these collections cannot be evaluated for budget projection purposes. Course work should take about three weeks to one month and all personnel could be trained at the same time. The costs (excluding salaries of the trainees) would be about $1,000 per person. As two librarians from each UC special collections department should be trained, total cost would be about $18,000 to train 18 librarians.

3. Book Binding and Paper Restoration

There is work, at a minimum, for two binder-restorers at each UC general library system. Based on locally available training the course work would cost about $4,000 per person per year. With salary and benefits included for each trainee (about $16,000/year) the estimated costs are as follows:

Year	Number in Training	Cost
1	4	$ 80,000
2	8	160,000
3	12	240,000
4	12	240,000
5	12	240,000
6	8	160,000
7	4	80,000
	Total	$1,440,000

These costs are based on a three-year training program and further marginal costs should be anticipated for specialized course work beyond the elementry three-year program. After seven years this program would provide UC with about half the number of trained staff that the Library of Congress employs to work on a collection of equivalent size.

III. Treatment

The treatment of deteriorating library material involves at least four major programs:

1) Mass deacidification of acid material

2) Microfilming of brittle material

3) Restoration of rare or unique material

4) Inclusion of bibliographic information on treated items in machine readable data bases

1. Mass Deacidification

At the current time there are no cheap and easily performed mass deacidification processes available for acid library material. The only practical treatment process, which involves interleafing the acid material with a neutralizing substance impregnated into a paper sheet, needs further research. The need for research in this area is underscored by my estimate that 19% of the UC libraries' collections need some form of deacidification treatment.

2. Microforming

Microforming of brittle materials is quite feasible and several small projects are already underway in the UC libraries. From data gathered and analyzed by the Library Studies and Research staff, it is estimated that about 4.5% of the UC libraries' collections (715,000 volumes) may be in need of preservation microforming. Based on a five-year project, the cost of microforming this portion of the collections is estimated at $25,000,000 for selection, labor, and overhead. Equipment costs would add another $500,000 (in the first year of the program) to that figure for a total estimated cost of $25,500,000. This project would cost about $5,000,000 per year on a systemwide basis or approximately $36.00 per volume treated.

3. Restoration Treatment

Much of the material in special and rare book collections in UC libraries needs expensive restoration treatment. The cost of this treatment varies from $5.00 to $5,000 per volume and the work demands a high degree of knowledge and skill. Until such trained personnel are employed in the UC libraries this work must be done by consultant restoration-binders. Unfortunately, the extent of

the work that needs to be done in these collections will remain unknown until UC librarians are trained to assay the collections for damage. Only one collection in the UC library system has been assessed for such damage, and in that collection only the rare books, excluding other special collection materials. For this one middle-size collection it is estimated that, in 1978, $250,000 would have been needed to restore the rare books alone. On the average this collection requires about $30.00 a volume in restoration or conservation treatment. Since other libraries in the UC system do not report holdings in "rare books," systemwide budget projections using this average figure are not possible. However, a budget of $20,000-$80,000 per annum (depending on collection size) should be allocated as soon as possible for this work. This level of dedicated budget would encourage private sector restorers to work with the University. At the same time the knowledge that such monies were available would encourage expansion of current private sector training programs which would, in turn, benefit UC staff training programs. These allocations should rise for several years and then decline as trained UC staff begin to take over the restoration treatment. Yearly appropriations might be at the following level:

Year	Cost
1	$ 360,000
2	400,000
3	500,000
4	400,000
5	360,000
Total	$2,020,000

4. Machine Readable Data Bases

There is a need for bibliographic control of materials treated in expensive preservation programs. This control has both local and national components which require implementation to reduce the large costs of unnecessary duplication of treatment.

At the local level, the UC libraries need to develop standards for creating machine readable entries for rare books and special collections materials. These records would need special fields to indicate any restoration treatment which has been done. The current condition of untreated material would also need notation. A concerted program to include microform masters in the UC Union Catalog should also be a priority item to reduce costs and duplication of effort in preservation microforming programs. A modest budget allotment should be made available to implement the design of such record formats. A budget of $10,000-$15,000 for one or two years should expedite this development.

At the national level the National Register of Microform Masters (NRMM) should be converted to machine readable format. At the

present time the NRMM is only updated every five years. This reporting delay is unacceptable when each volume unnecessarily microformed costs each institution $35.00 to $50.00. An alternative might be to have OCLC or RLIN develop its own Register in machine readable form to replace the manual NRMM.

IV. Research

Research in the areas of mass deacidification of bound volumes, paper deterioration, alkaline pulping processes, and paper strengthening are desperately needed. Such research programs developed by the Library Studies and Research Division in conjunction with the Forest Products Laboratory and other departments could be undertaken in the UC system. Start-up costs for a significant research program could be as much as $500,000 to $1,000,000 depending upon the scope of the research program. Further grants of $200,000-$250,000 per annum would probably be sufficient to carry the research each year. For a five-year program total costs might be $1,300,000 to $2,000,000.

V. Summary of Estimated Program Costs

Any University of California program which is designed to slow or halt the deterioration of library materials must address four major program areas. These areas are: 1) environmental control, 2) training in conservation and preservation, 3) treatment of deteriorating material and, 4) research. There are various subdivisions in each of these areas which are noted earlier in this paper. Given these four areas, the following costs were estimated for the implementation of full or partial programs in each of the four areas in the University of California libraries. Each program would vary in length from five to seven years and only total costs are given below.

Area	Campuses Involved	Estimated Cost
1. Environmental Control	4	$ 7,400,000
2. Training	9	1,958,000
3. Treatment	9	
a. Microfilming	9	25,500,000
b. Restoration	9	2,020,000
c. MARC Records	9	30,000
4. Research	(Systemwide?)	1,500,000
	TOTAL	$38,408,000

References

1. Bruer, J. Michael. Toward a California Document Conservation Program. California Library Authority for Systems and Services, San Jose, Oct. 1, 1978.

2. Heron, David W. Conservation of Library Resources In The University of California. Office of the Assistant Vice President--Library Plans and Policies, University of California, Systemwide Administration, March, 1978.

3. Task Group on the Preservation of Library Material. Report. University of California, Library Council. May 13, 1977.

4. Cunha, George. Conservation of Library Materials. The Scarecrow Press, Inc. Metuchen, New Jersey, 1971.

5. Wessel, Carl. "Environmental Factors Affecting the Permanence of Library Materials." Library Quarterly. 40(1):39-83, (Jan) 1970.

6. Williams, Gordon. The Preservation of Deteriorating Books: An Examination Of The Problem With Recommendations For A Solution. ARL Committee on the Preservation of Deteriorating Library Materials. September, 1964.

7. Kimberly, Arthur and Emley, Adelaide. A Study of the Removal of Sulphur Dioxide From Library Air. U.S. Department of Commerce. Bureau of Standards Miscellaneous Publication No. 142. October 17, 1933.

8. Clapp, Verner. "The Story of Permanent/Durable Book Paper, 1115-1970." Restaurator. Supplement Number 3, 1972.

9. Browning, B. "The Nature of Paper." Library Quarterly. 40(1):18-38, (Jan) 1970.

10. Johnson, Rossiter. "Inferior Paper a Menace to the Permanency of Literature." The Library Journal. 16:241-242, (August) 1891.

11. Committee on the Deterioration of Paper. Report. Journal of the Society of Arts. XLVI:597-600, (May 20) 1898.

12. "Durability of Paper." The World's Paper Trade Review. 96(14):1097-1110, (October 2) 1931.

13. Shatzkin, Leonard. "Publishing on Permanent Papers." Library Quarterly. 40(1):113-127, (Jan) 1970.

14. Rothschild, A. "The Permalife Story." Indian Pulp and Paper. 17(5): 305-307, (Nov) 1962.

15. Strachan, James. "Imperishable Documents." The Paper-Maker and British Paper Trade Journal. Supplement. 87(1):TS33-TS34, (Jan. 1) 1934.

16. Strachan, James "The Durability and Permanence of Modern Paper." The Paper-Maker and British Paper Trade Journal. Supplement. 81(2): lxi-lxiii, (Feb. 2) 1931.

17. Farquhar, Samuel. "Permanent Paper in Scholarly Publishing." Paper Trade Journal. 98(11): 2, (March 15) 1934.

18 Grycz, Czeslaw. Production Manager, University of California University Press. Personal Communication, 1979.

19. "Report of the Committee on the Deterioration of Paper." Journal of the Society of Arts. XLVI(2374):597-601, (May 20) 1898.

20. Barrow, W. J. Research Laboratory. Permanence/Durability of the Book, I. W. J. Barrow Research Laboratory, Richmond, Virginia, 1963.

21. Barrow, W. J., Research Laboratory. Permanence/Durability of the Book, V. W. J. Barrow Research Laboratory, Richmond, Virginia, 1967.

22. Church, Randolph (ed.). Deterioration of Book Stock, Causes and Remedies. Two studies on the permanence of book paper conducted by W. J. Barrow. Virginia State Library, Richmond, Virginia, 1959.

23. Kingery, Robert. "The Extent of the Paper Problem in Large Research Collections and the Comparative Costs of Available Solutions." In: Permanent/Durable Book Paper, Summary of a Conference Held in Washington, D.C., September 16, 1960. Virginia State Library, Richmond, Virginia, 1960.

24. Williams, J. C. "Chemistry of the Deacidification of Paper." International Institute for Conservation of Historic and Artistic Works. American Group. Bulletin. 12(1):16-32, (Oct) 1971.

25. Belanger, Terry. "The Price of Preservation." Times Literary Supplement. November 18, 1977. p. 1358.

26. Cunha, George. "Tripartite Concept of Conservation." In: Morrison, Robert et al (eds.) Conservation Administration. The New England Document Conservation Center, North Andover, Massachusetts, 1975.

27. Library of Congress. Annual Report of the Librarian of Congress. Washington, D.C. 1977.

28. Waters, Peter. Library of Congress Preservation Office. Personal Communication, 1977.

29. Barker, Nicolas. "Blight in Bloomsbury." Times Literary Supplement. November 18, 1977. p. 1359.

30. Barrow, W. J. Manuscripts and Documents, Their Deterioration and Restoration. University Press of Virginia, Charlottesville, 1976.

31. "Size of the Libraries of the University of California on 30 June, 1978." University of California, The General Library, Berkeley. Revised 15 Sept. 1978.

32. Hawley, Gessner (ed.) The Condensed Chemical Dictionary. Van Nostrand Reinhold Company, New York, 1977.

33. Langwell, W. H. "The Vapour Phase Deacidification of Books and Documents." Journal of the Society of Archivists. 3:137-138, 1966.

34. "Instructions for Using Interleaf VPD Materials." Interleaf Inc. Minneapolis, Minnesota, 1979.

35. Dupuis, R. N., Kusterer, J. E., and Sproull, R. C. "Evaluation of Langwell's Vapor Phase Deacidification Process." Restaurator 1: 149-164, 1970.

36. Banks, Paul. "Education for Conservators." Library Journal 104(9): 1013-1017, (May 1) 1979.

37. Smith, Richard. "Paper Impermanence as a Consequence of PH and Storage Conditions." Library Quarterly. 39:153-195, (April) 1969.